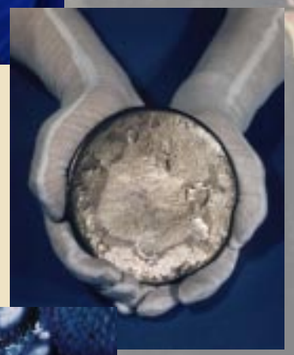
Historical and present day use of HEU.

***RIGHT:*** *Historically HEU was first used to produce atomic weapons. A replica of "Little Boy", the atomic bomb dropped over Hiroshima, Japan in 1945, is shown in the foreground.*

***ABOVE:*** *Hotcells are used to chemically process radioisotopes (fission products from irradiated HEU fuel) for nuclear medicine applications.* ***RIGHT:*** *While primarily a mixed oxide reactor, the Fast Flux Test Facility in Washington State has been used to test the effectiveness of using HEU fuel assemblies.* ***BELOW:*** *Small scale reactors, such as the TRIGA shown here, run on HEU fuel and are practical for conducting tests and training nuclear engineering students.*



***RIGHT:*** *Uranium 235 is chemically recovered from various forms of HEU and HEU-contaminated materials and converted to metallic discs or "buttons". The buttons can then be safely stored or converted to other forms for appropriate uses such as fuel for nuclear reactors.* ***BELOW:*** *Nuclear medicine has been theorized for a hundred years. Today, "Smart Bullets", radioisotopes derived from HEU, have proven effective in the treatment of several forms of cancer.*

**In order to establish a foundation for decision-making we need a comprehensive understanding of the environment, safety and health issues surrounding our entire inventory of fissile materials.**

***Hazel O'Leary***
***March 15, 1994***

# F O R E W O R D

This report presents the results of a systematic evaluation of environmental, safety and health (ES&H) vulnerabilities associated with Department of Energy inventories of highly enriched uranium (HEU). This is the fourth comprehensive assessment of DOE's hazardous material inventories led by the Office of Environment, Safety and Health. Previous studies assessed vulnerabilities associated with spent nuclear fuel (November 1993), toxic chemicals (September 1994), and plutonium (November 1994). Each assessment has aimed to provide DOE management with information needed to evaluate risks to workers, the public, and the environment and allocate resources accordingly. Program and site-specific corrective action plans associated with this report identify specific actions needed to address the most serious risks.

Overall, fewer vulnerabilities were identified by this assessment than were found by the complex-wide plutonium vulnerability assessment. This is generally a consequence of the nature of uranium itself which does not oxidize as rapidly as plutonium and is less radioactive, producing far fewer issues related to packaging. The most significant HEU vulnerabilities stem from uranium 233, a fissile and highly radioactive isotope, and from HEU that has been mixed or collocated with plutonium or fission products. Most HEU vulnerabilities are associated with poor facility conditions and institutional weaknesses.

DOE stopped producing HEU for nuclear weapons in 1992. Much of the material remains today in forms and facilities that are not safe or suitable for long-term storage. Supplies of HEU are located throughout the DOE complex and await development of options for disposal.

HEU is not as radiologically hazardous as plutonium, but it does present substantial safety and environmental challenges. The radioactivity of HEU per unit mass is much less than that of plutonium; however, there are more than 250 metric tons of HEU in the inventory, approximately 10 times more than plutonium. Also, during the era of weapons production, HEU was not as well controlled radiologically as plutonium, although it presents just as great a risk for nuclear criticality accidents. The Department is also facing the challenge of how best to store and manage fissile materials as they are returned from dismantled weapons. These factors contributed to the need for this environmental, safety and health vulnerability assessment.

The most important consequence of these assessments is the implementation of corrective actions to address the vulnerabilities. These plans are developed and implemented by DOE line programs. The Office of Environmental Management coordinated the action plans and tracked progress for prior vulnerability assessments, ensuring that issues were elevated to appropriate managers and coordinated with the Office of Environment, Safety and Health. The Office of Defense Programs will assume that role for the HEU study. Like the action plans for management of spent nuclear fuel and plutonium ES&H vulnerabilities, the HEU corrective actions will engage the complex for a significant length of time and will demand sustained leadership and attention.

The need for complex-wide assessments became apparent following a growing number of serious incidents at DOE facilities, and later from the recognition that baseline information was needed to safely manage hazardous materials. Through these assessments, it became clear that the public living near DOE facilities, as well as oversight groups and contractors, have valuable perspectives. It is also clear that, in a time of competing national needs and scarce resources, the safe management of the DOE fissile material inventory requires the involvement of all these groups. It is our hope that this assessment will usefully integrate the perspectives of the Federal and contractor managers who must manage these materials and inform the stakeholders of vulnerabilities associated with HEU inventories.

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